REMARKS/ARGUMENTS

Claims 1-24 are pending in the application and these claims are all presently rejected. Claims 1, 2, 11 and 13 are amended herein to change the composite ratio of Mo in the subject claims from "1.1 – 4.5 wt%" to "2.1 – 4.5 wt%". Entry of the claim amendments and reconsideration of the application is respectfully requested.

Status of Previous Rejections

Applicants note with appreciation that, as indicated on pp. 2-3 of the Office Action:

1) The rejection of claims 1-24 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over, Cetel et al. EP 0 848 071 A1 has been withdrawn.
2) The non-statutory obviousness-type double patenting rejection of claims 1-24 as being unpatentable under claims 1-3 of U.S. Patent No. 6,966,956, has been withdrawn in view of the Terminal Disclaimer filed on March 23, 2009

Current Claim Rejections

The Examiner asserts in the present Office Action that claims 1-24 directed to applicants' Ni-based single crystal super alloy overlap with the disclosure contained EP 0 848 071 A1 of Cetel et al., while applicants' claims 1, 2, 7-11 and 20-24 overlap with the disclosure found in U.S. Patent No. 6,190,471 to Darolia et al. The indicated claims of the present application are thus rejected as being allegedly obvious over both of the subject references, taken individually.

Furthermore, with regard to FIG. A that was provided with applicants' response to the previous Office Action issued in this case to illustrate features believed to distinguish applicants' claimed invention over the disclosure of Cetel, the Examiner states (Office Action, p. 12) that, "the stress lines of the present application and the prior art are very similar to each other, specifically between the Larson-Miller Parameters of 44-46. Applicant has not shown the criticality of the stress load, particularly how the difference of stress loads of a few ksi between the present application and the prior art, for example at a Larson-Miller Parameter of 45, exhibits a significant deference in strength between the instant alloy and the alloy of the prior art".

The Examiner's rejection of applicants' claims, based *inter alia* on the reasons as

summarized above, are thus respectfully traversed for the reasons which follow.

To begin with, it is natural that the difference in creep properties (stress lines) between alloys having different composition is not uniform in the entire range of Larson-Miller Parameters (LMP). For example, as shown in FIG. A (titled: "Fig. 6") attached to this Amendment, the stress lines of Cetel (which represent the "INVENTION" in FIG. A) and the prior art (referred to as "PRIOR ART" in FIG. A) are very similar in the LMP of 41 and 51. Therefore, in these ranges of LMP, Cetel (i.e., the invention) does not display an advantage over the prior art. Furthermore, as the Examiner states, the stress lines of the present application and Cetel are very similar in the range of LMP of 44 to 46. However, in the range of LMP of 49 or more, the stress line of the present application is clearly superior to that of Cetel (the stress line of the super alloys according to the present application does not fall within the same range as Cetel). Therefore, in the creep properties in the range of LMP of 49 or more, the characteristics of the Ni-based single crystal super alloy according to the present application are significantly better than those of Cetel.

The reason why, in applicants' view, the stress line of the present application does not fall into the values attributable to Cetel in the range of LMP of 49 or more is believed to be that when the creep properties of the alloy in the range of LMP of 41 and in the range of LMP of 49 are compared under the same creep rupture time, the experimental temperature of LMP of 41 becomes 1750°F (950°C), whereas the experimental temperature of LMP of 49 becomes 2000°F (1100°C). That is, the experimental temperature of LMP of 49 is higher than that of LMP of 41.

FIG. B attached hereto (reprinted from R.C. Reed, "THE SUPERALLOYS" Cambridge University Press, 2006 - the arrows have been added by the applicants) demonstrates a relationship between the experimental temperature and the formation of TCP phases (which deteriorates creep properties of the alloy) in two alloys with/without Ru doping. When the experimental temperature is1750°F, a long time is required to form TCP phases in the alloy even though the alloy does not include Ru. In contrast, when the experimental temperature is 2000°F, TCP phases are formed in the alloy not including Ru in approximately 20 hours. In contrast, however, TCP phases do not form in the alloy which includes Ru after approximately 350 hours. In accordance with the above, therefore, in the range of LMP of 49 or more the formation of TCP phases is <u>delayed</u> in the alloy of the present application which includes Ru - compared to the alloy of Cetel which does not include Ru (refer to Table II of Cetel). It is assumed that the

difference between the stress line of the present application and Cetel in the range of LMP of 49 or more is caused by this delay.

Further, with regard to the weight percentage of Cr in the claimed single crystal super alloy, applicants note that, in general, Cr is added to the alloy in order to improve corrosion resistance. However, the alloy of Cetel includes a small amount of Cr compared to that found in conventional alloys (refer to lines 25 to 26 on page 3 of Cetel). In the case of Cetel, composite ratio of elements such as W, Re, Mo and the like which improve high temperature creep strength of the alloy can be increased by reducing the composite ratio of Cr (refer to lines 28 to 30 on page 3 of Cetel). According to this concept as taught in Cetel, the composite ratio of Cr should be reduced as far as possible such that the indispensable corrosion resistance of the alloy can be maintained.

Furthermore, as shown in the attached FIG. C (FIG. 11 of Cetel - the arrow has been added by the applicants), the oxidation resistance of the alloy of Cetel is not improved when the composite ratio of Cr is 1.8 wt% or more. In addition, the composite ratio of elements such as W, Re, Mo and the like is reduced and the high temperature creep strength of the alloy is decreased in accordance with an increase of the composite ratio of Cr. Therefore, in Cetel, the optimum range of Cr in the alloy is determined to 0.4 to 1.75 wt%.

Moreover, as applicants have previously noted in a prior response filed in this application, in the laid-open application publication of Cetel (EP 0 848 071 A1), the composite ratio of Cr in the alloy is 0.4 – 2.9 wt%. However, in the patent publication of Cetel (EP 0 848 071 B1), the composite ratio of Cr in the alloy is limited to 0.4 – 1.75 wt%. This clearly shows that the composite ratio of Cr in the alloy of Cetel should be minimized as much as possible.

In contrast, the composite ratio of Cr in the alloy of the present application is 2.0 wt% or more. This range is higher than the optimum range of Cr in the alloy of Cetel (0.4 to 1.75 wt%). Furthermore, as also described above, in the present application, the creep strength of the alloy is improved by employing the influence of Ru upon the creep properties. Therefore, the present application and Cetel are basically different in their concepts and the measurements taken for improving the creep strength of the alloy based on the concepts.

Turning now to a discussion of the 'second' rejection in the Office Action, i.e., based on the Darolia et al. U.S. '471 patent, the applicants have amended the composite ratio of Mo in the alloy of the present application to 2.1 – 4.5 wt%. This composite ratio of Mo in the alloy does

not overlap with those of Darolia but still overlaps with those of Cetel. However, as shown in the attached FIG. D which shows the relationship between composite ratio of Mo in the alloy and minimum creep rate of the alloy, minimum creep rate is drastically decreased when the composite ratio of Mo in the alloy is 2.1 wt% or more. This phenomenon means that the creep properties of the alloy are non-linearly improved when the composite ratio of Mo in the alloy is 2.1 wt% or more. In contrast, Cetel does not mention the influence of Mo to the creep properties of the alloy, and therefore, the present application is believed by applicants to be distinguishable over Cetel even though the composite ratio of Mo in the alloy still overlaps with those of Cetel.

A declaration under 37 C.F.R. 1.132 of Mr. Hiroki Yokota is provided with this response demonstrating how the values plotted in Fig. D were obtained is provided as an attachment to this Amendment. Entry of the declaration is respectfully requested.

Based on the claim amendments and the remarks presented above, as well as the evidence contained in the Yokota declaration under 37 C.F.R. 1.132, the Examiner is respectfully requested to reconsider and withdraw the rejection of applicants' claims under 35 U.S.C. §103

THIS CORRESPONDENCE IS BEING SUBMITTED ELECTRONICALLY THROUGH THE PATENT AND TRADEMARK OFFICE EFS FILING SYSTEM ON December 2, 2009

MAF:stb

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FIG. A

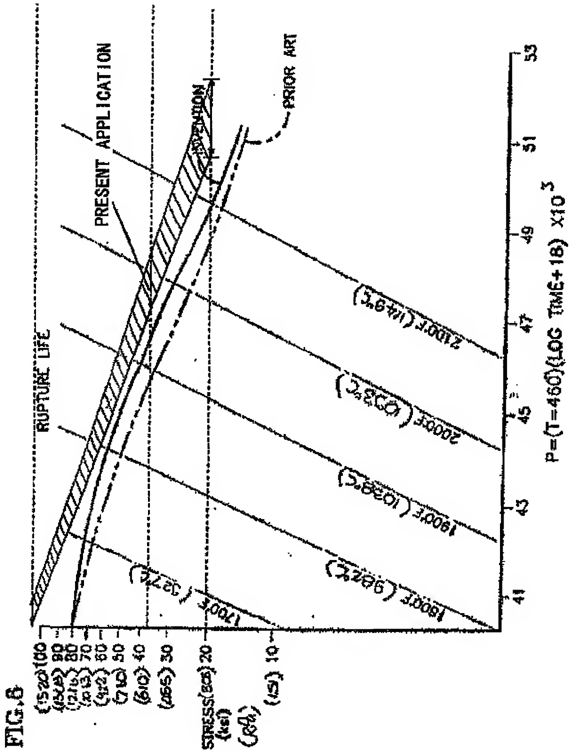

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FIG. B

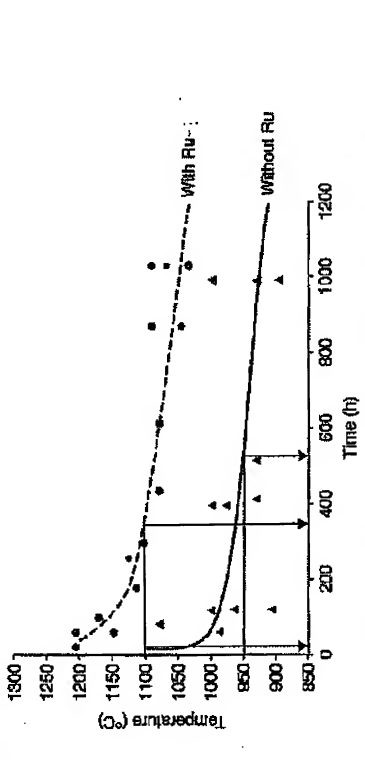

Fig. 3.39. Time–temperature-transformation (TTT) diagrams for the formation of TCP phases in two single-crystal superalloys, one with and the other without Ru-doping -- the base composition being Ni–12Co–2.5Cr–9W–6.4Re–6Al–5.5Ta–0.15Hf (wt%). (Courtesy of An-Chou Yeh.)

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FIG. C

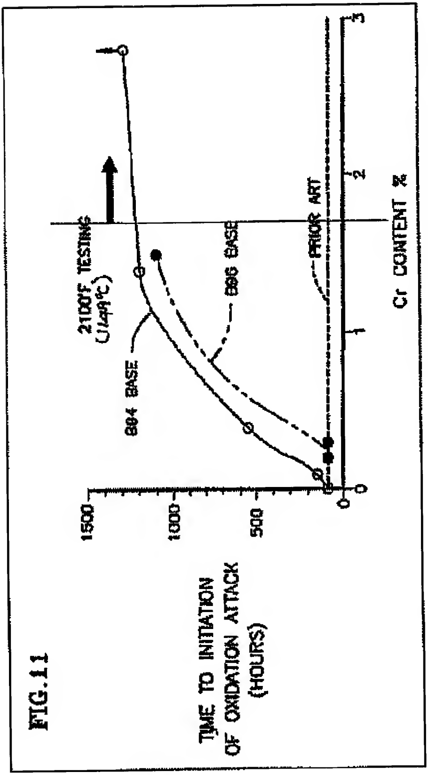

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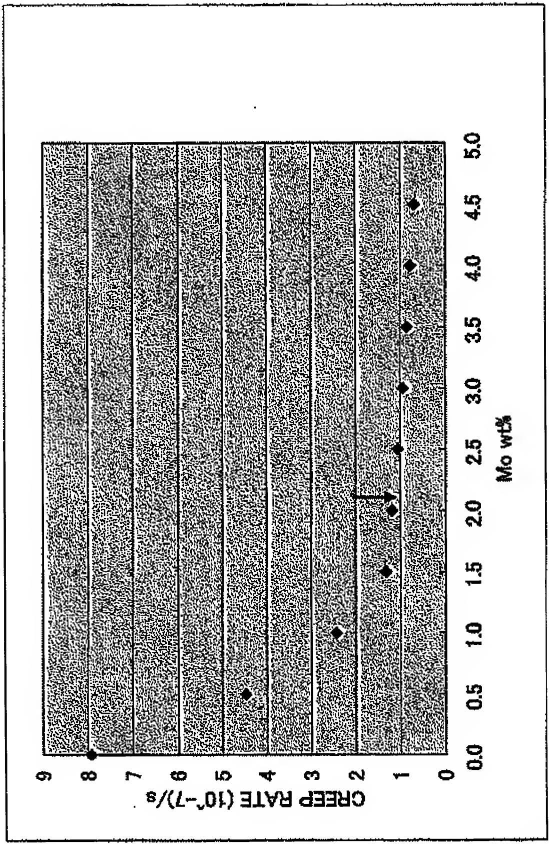
FIG. D



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